

Effect of reservoir sedimentation on water availability and performance

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Abstract

Reservoir sedimentation has the effect of decreasing water availability for various purposes and the useful life of a reservoir. This problem can be exacerbated in catchments undergoing significant land-use changes, e.g. deforestation, road construction, mining and cultivation along the slopes, etc. all of which encourage soil erosion and increased sediment yields. Such effects are seldom considered in reservoir performance evaluation whereas they should because they can be significant. In this study we have analysed the sedimentation effects on the performance of Pong multi-purpose reservoir on the Beas River in India. The Annual average sediment deposition in the Pong reservoir is about 25 Mm^3 , of which 7 Mm^3 (~26%) is deposited in dead storage zone and 18 Mm^3 . Indeed by the year 2009, almost 8.48% of the live storage capacity of Pong reservoir has been silted up; this is projected to reach 20% by the year 2050. To assess the effect of the increasing sediment deposition on the performance of the reservoir, behaviour simulations were carried out, using the available 12-year (2001 – 2012) monthly runoff inflow data and guided by rule curves that were progressively adjusted to account for the sediment deposition. Reservoir performance was summarised in terms of reliability, resilience and vulnerability, and compared with no sedimentation situation. The results show that the volume-reliability decreased from its current estimate of 87% to 70% if 20% of the capacity is lost to sedimentation. This is in addition to a near doubling of the failure duration (65 months as opposed to 35 months) and the concomitant worsening of other performance indices notably the vulnerability. Such effects are bound to compound the challenges which projected climate change is already having on the sustainability of water resources in this Himalayan Basin in India.